

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 43.

May, 1941.

No. 509.

ON THE USE OF THE TERMS "SUBSPECIES" AND "VARIETY"¹

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WORDS are the means by which man expresses his ideas. In the development of a large vocabulary, the human species far surpasses all other members of the animal kingdom. This vocabulary is not a static thing. Instead, it is an ever changing affair. New ideas, new discoveries, new inventions, new thoughts:—these all require either new words or redefinitions of the old. Likewise, other words, no longer necessary, drop out of usage and become obsolete. The study of these word-changes affords a fascinating field of investigation for the philologist.

To express their precise ideas, scientists have had to choose between inventing new terms or redefining in a particular fashion old and familiar words. The terms "subspecies" and "variety" both have different shades of meaning. "Subspecies," being a scientific term, is unfamiliar in our language except among biologists. As might be expected, since "subspecies" is not a popular term, it has undergone a less varied usage than has the word "variety". Persoon seems to have introduced "subspecies" in his *Synopsis Plantarum* in 1805. The literature since then demonstrates the conservative usage of the term. Yet Fernald, who is the most recent and active exponent of the term variety to the exclusion of the term subspecies, in 1936, stated that "the term subspecies is used in so many ways as to be vague." Also, he stated that the term variety, "as used by such discriminating recent taxonomists as the late C. E. Moss, the late Otto Holmberg

¹ Printed at the author's expense to insure immediate publication.

and countless others of the past (Linnaeus, Willdenow, DeCandolle, Kunth, Schlechtendal, Hooker, Torrey, Gray and scores of others), is reasonably clear," but in that same publication Fernald found it necessary to set matters right by reducing to the grade of *formae* varieties of Linnaeus, Torrey and Gray, Nuttall, Lange and Pursh. Further, this reduction of *varietas* to *forma* has been going on through the years to the extent that in the pages of the single journal, RHODORA, there are 166 examples of varieties changed to forms. It is interesting to note that Fernald made 91 of these changes and that 36 times he had to correct the earlier botanists whom he claims to follow. Fernald implies that he understands what Linnaeus and Gray intended to mean by variety, but in making these corrections he modifies their application of the term. The discrepancies between taxonomists in applying the term variety clearly indicate that there has not been uniformity in its use. It seems reasonable to consider that not only is variety a popular term which has been borrowed by the scientists and given a more specialized meaning, but taxonomists themselves have not been in agreement concerning how it should be defined. While it is true that biologists regard the term variety as indicating a group of less than specific rank, non-biologists use the word as synonymous with "kind" or "species," without regard for taxonomic position. This usage can not be stopped, no matter what legislation a Botanical Congress might enact.

It is questionable whether subspecific categories of different grades should be rigidly defined. According to Rehder in 1927, the botanists of Harvard University in 1904 voiced the following opinion in their proposed amendments to the Paris code: "Subspecies, varieties and forms are not sharply definable or mutually exclusive categories, it is therefore better that, although their separate rank is maintained for classificatory purposes their names should be regarded as forming a single nomenclatorial class." Today, with the steady development of an experimental method in taxonomy, these categories are much nearer definition than in 1904. Yet, it still seems desirable to permit freedom to the individual worker in his concept of categories, not only of the subspecies, but also of the specific category which is today much more capable of objective interpretation than ever before.

The new taxonomy is based on the experimental approach, with its consideration not only of gross morphology, but of histology, chromosomes and chromosomal behavior, and breeding relationships. The rising group of experimental taxonomists, of whom the late H. M. Hall was a pioneer, should not now be hampered by rigid definitions made by non-experimentalists.

In 1753, in *Species Plantarum*, Linnaeus employed only one subspecific category, namely the variety. This term had been carefully defined in an earlier publication, "*Philosophia Botanica*," 1751, also still earlier elsewhere. Quoting the English translation of Ramsbottom in 1938, variety was defined by Linnaeus as "a plant changed by an accidental cause due to the climate, soil, heat, winds, etc. It is consequently reduced to its original form by a change of soil. Further, the kinds of varieties are size, abundance, crisping, colour, taste, smell. Species and genera are regarded as always the work of Nature, but varieties as more usually owing to culture." From these words, it is evident that Linnaeus defined variety for what are now regarded as modifications by experimental taxonomists, although in practice he included both modifications and trivial genetic variations. Such variations, by modern standards, are mostly random affairs of undemonstrable evolutionary importance. Yet, in *Species Plantarum*, Linnaeus occasionally treated as varieties groups of greater importance than modifications and trivial variations, although his usage was preponderantly in accord with his definition in "*Philosophia Botanica*". The majority of the 224 named varieties in edition 1 of *Species Plantarum* support this contention. Before citing some of these, it should be remarked that Linnaeus did not write the abbreviation "var." before his varieties. Instead he designated the epithets in different style of printing and by Greek letters. Those modern writers who, in synonymies in taxonomic works, substitute the "var." for the Greek letters are not exactly quoting Linnaeus. Returning now to examples of Linnean varieties, these include *Tanacetum vulgare* β *crispum*, and *Malva verticillata* β *crispa*, indicating crisping of the textbook-precept; *Beta vulgaris* β *rubra*, indicating color; *Viburnum Opulus* β *roseum*, for a color variation with all flowers sterile; and varieties, too numerous to mention, of the minor horticultural sort, under species like *Prunus Cerasus* with

11 such, *P. domestica* with 14 such, *Pyrus Malus* with 6 such, and *Brassica oleracea* with 11 such.

Noting that Linnaeus occasionally designated some more important entities as varieties, for example *Circaea lutetiana* β *canadensis*, Fernald (1940) has claimed that in actual practice Linnaeus "generally designated as varieties indigenous plants which he considered to be natural (often geographic) variations within the broad limits of his specific concept." From this assertion, Fernald passed by easy stages to the apparent conclusion that varieties are plants with strong geographic isolation. Careful study of the 224 named varieties in *Species Plantarum* reveals that most Linnean varieties are no such thing, but are minor variations in color, leaf-cutting, crispation, pubescence, habit, and similar characters. An occasional one is geographically significant.

After Linnaeus, writers continued to employ the one category below the specific level until Persoon in 1805 introduced the term "subspecies" into the literature. In the introduction to his *Synopsis Plantarum* occurs the phrase, "varietates praecipue et subspecies non omissae sunt." Persoon's usage is poorly explained, but from the content of his work there is probable indication that the subspecies are designated by Greek letters, while the varieties follow after the specific diagnoses without special prefix. The two categories beneath the species seem only weakly differentiated by Persoon, subspecies being used for the major morphological variations and varieties for the minor ones. Persoon's publication is of significance because it seems to be the starting point for the term "subspecies." Also, it should be noted that "subspecies" was the next term after "variety" to be introduced into botanical literature for subspecific units and it was used from the first for a variation of greater value than variety. The term *forma* did not appear until later.

In 1864, Alphonse DeCandolle, in his *Prodromus*, made the combination *Quercus robur* subsp. *pedunculata* α *vulgaris*. Here the higher category was clearly designated as subspecies, while the epithet prefixed by the Greek letter was the variety. Some might argue that DeCandolle's subspecies were merely super-varieties intercalated between the species and variety, but statements from the "Laws of botanical nomenclature adopted by the

International Botanical Congress held at Paris in August, 1867," do not support this opinion. Instead, subspecies were defined as the most important variations of the species. Article 14, translated into English by H. A. Weddell, states that "Modifications of cultivated species should, where possible, be classed under the wild or spontaneous species from which they are derived. For this purpose the most striking are treated as subspecies, and when constant from seed they are called races (*proles*). Modifications of a secondary order take the name of varieties, and if there be no doubt as to their almost constant heredity by seed they are termed subraces (*subproles*)."

Further, DeCandolle, in the commentary of the rules, wrote "When a modification of a species is habitually hereditary, it becomes properly speaking a *subspecies*, in other words, there may be hesitation as to whether it ought not to be called a species, and many would call it so. If its characters be less striking, and transmission by seed less frequent, every one would then call it a *variety*." Since Fernald included Alphonse DeCandolle in the army of "outstanding scholars, who correctly used the honorable old term *varietas*," whom he claims to follow, it is interesting to note that DeCandolle does not define a variety as a unit with strong morphological and geographic differences. It is true that some of DeCandolle's varieties do exhibit strong morphological and geographic differences, but it is also true that many of them are modifications of slight importance. Some of DeCandolle's varieties of the latter type have been reduced from varietal status to *formae* by Fernald. The conclusion is that in 1867, whether or not the suggestions of the rules were carefully followed, the subspecies was designated as the most important category under the species. Further, in the list of subspecific categories enumerated in Art. 10, *forma* was still not enough in general usage to be mentioned, while variety was defined in Art. 14 in a way similar to the present day concept of *forma*.

After 1867, many European workers began to employ subspecies for the most important variations under the species. The emphasis, to be sure, was on the morphology. The series of specimens in herbaria were seldom large enough to make possible a satisfactory understanding of geographical distribution. Only now are the great collections beginning to be adequate on this

basis, and for many groups and regions, the available specimens are doubtless still scant indication of the true state of affairs in nature. Under these circumstances, it was scarcely possible for the older workers to have a geographical concept for subspecies, variety, or any other category. Furthermore, only in the present century has the geographical method come into its own in taxonomy. For an interesting example of the growth of this method, illustrating the trend of things later in the century, see Wettstein's "Grundzüge der geographisch-morphologischen Methode der Pflanzensystematik," 1898.

In America, Asa Gray was one of the great leaders in botanical thought in the last century. In 1836, he wrote "Any considerable change in the ordinary state or appearance of a species is termed a *variety*. These arise for the most part from two causes, viz.: the influence of external circumstances, and the crossing of races." The wording of this definition changed somewhat in later works by Gray, but the same idea seems to pervade all his writings on the subject. This idea might be paraphrased as a variation from a type. The geographical criterion for variety was not cited by Dr. Gray, although some of his varieties, probably coincidentally, were geographically isolated. Gray disposed of the term subspecies by defining it as "a marked variety."

The successors of Dr. Gray at Harvard University seem to have followed him in their concept of variety. Even Fernald, in his early papers seems to have thus interpreted the category, for several of his varieties, made at that time, do not conform to his later concept of the term and have now been reduced to the grade of *forma*. Examples are *Juncus macer* var. *Williamsii* reduced to a *forma* by Hermann in 1938, and *Scirpus atrocinctus* var. *brachypodus* and *S. cyperinus* var. *condensatus* reduced to *formae* by Blake in 1913. Although these were good varieties by the standards of the earlier botanists, 101 of whom Fernald has listed in his paper in the July, 1940, issue of RHODORA, such varieties are now treated as *formae* by Fernald and his followers, while a modification of the concept of subspecies, as understood by DeCandolle and others, has been substituted for the Linnaean definition of variety.

One of the greatest influences in American plant taxonomy

in the early part of this century was the "American Code of Botanical Nomenclature" (1907). This code clearly preferred the use of subspecies for variations, lower than the species, which required nomenclatorial recognition. On the use of variety, the wording of the Note under Canon 4 is remarkably clear: "The term variety is relegated to horticultural usage."

In 1926, Hall presented a pioneer paper explaining the new experimental approach in taxonomy. He favored the term subspecies for the primary divisions of species and clearly indicated the confusion in the use of the term variety. Regarding variety, Hall wrote "the term has such a multiplicity of uses and so often applies only to races, ecologic responses, horticultural forms, or even to abnormalities that, in the opinion of the writer, its use in serious taxonomic work were better discontinued."

The earliest use of *forma* perhaps was by Miquel, who, in 1843, on page 169 of his *Systema Piperacearum*, described a *Forma capensis* of *Peperomia reflexa*. *Forma* is clearly a later term than subspecies, which was not even mentioned in the "Laws of nomenclature" propounded in 1867. Accordingly, if two categories beneath the species are to be recognized, as many botanists deem necessary, variety and subspecies have historical priority, the former for the minor variations of species and the latter for the more important ones.

It is not the province of this paper to discuss in detail the merits of a style of nomenclature with a single subspecific unit as contrasted with one with several subspecific units. Nor is it proposed here to explain why those variations of species are most important which are partly genetic and partly geographic or ecologic. For full discussion of these details, see the excellent papers by Clausen, Keck, and Hiesey (1939, 1940), by Dobzhansky (1937), and by various writers in the *New Systematics*, edited by Julian Huxley (1940). From the experimental point of view, the biologically most important natural unit under the species is the *ecotype* which can be determined only by experiment. To determine populations to be ecotypes, great care should be used: details of distribution should be meticulously plotted on maps; plants should be grown in experimental gardens; and specimens ought ideally to be analyzed both cytologically and genetically. Taxonomists, by the usual observational

methods, can often detect geographic and ecologic variations which are the counterpart of the *ecotype*. Such variations are the taxonomic subspecies. Ecotypes and subspecies represent the highest category below the species level. When the experimental part of the work has not been done, the conventional taxonomic designation, subspecies, should be used alone. It is hoped that the term "subspecies" will never become as carelessly applied as has the term "variety". If that should happen, "subspecies" will have lost much of its usefulness and distinctiveness.

The experimental technique is slow and often tedious. For that reason, it will not appeal to many persons. Experimental studies in taxonomy should have the active support and cooperation of groups of biologists, each specialists in their own fields. In this way, the greatest progress can be made. To ignore the new techniques in taxonomy is not the way to progress. If there are difficulties, they must be surmounted. Science is not a static thing. To appeal to the good old days of Dr. Gray and Linnaeus is to imply such a condition. Had medical scientists followed that highly conservative policy, modern medicine might not have progressed beyond Hippocrates. Taxonomists must now be ready to accept the best information that is available from genetics, cytology, physiology, and anatomy.

If there is to be greater cooperation between workers in the various specialties of science, the barriers between zoologists and botanists must be removed. One way to achieve this is to keep the terminology as nearly similar as possible. Most vertebrate zoologists today employ the subspecies, writing the names as straight trinomials. The zoological subspecies are the largest units below the species-level which exhibit strong morphological differences and geographic distinctness. The general acceptance of subspecies by botanists for this same concept would thus represent a forward step in the direction of uniform practice. This would be a great advantage, for much ecological work is now done that considers both the plants and animals in an environment.

Critics of the subspecies say that it is a term merely substituted for variety. If these botanists see no difference between the terms, why do they in turn insist on reducing subspecies to

varieties? As a matter of fact, the terms are not synonymous and changes should not be made in either direction, as is often done, without proper corroboration of fact.

As regards the argument that the use of variety is reasonably clear, the seventh edition of Gray's Manual, edited by Robinson and Fernald, may be cited. One colleague, commenting to me in a letter, reports that he has analyzed from the standpoint of consistency an unselected series of 105 varieties in it. Of these, he states that 42 are geographical, while 63 are not. Further, he points out that this inconsistency exists within the same species, where some of the varieties are mere *modifications*, while others are the equivalent of subspecies.

Some biologists claim that the use of subspecies represents merely a state of mind, and that the argument resolves itself into a matter of terminology. They argue that taxonomy has to deal with a mixed up world in which a natural ranking of units cannot be expected. They mistake the confusion caused by a lax usage of terms on the part of many taxonomists for confusion in nature. This idea of confusion is not supported by the experimental data, which indicate that nature is orderly and that at any time in man's experience, the natural units may possess a high degree of reality. If the proper use of subspecies, with a more precise meaning than the carelessly applied and confused term "variety," will contribute toward supplying a biological basis for taxonomy, its acceptance certainly should be considered by all friends of science.

In conclusion, the principal points of this discussion may now be summarized. The Linnaean variety as defined in the "*Philosophia Botanica*" and as illustrated by many examples in "*Species Plantarum*," was a variation of a minor sort within the species. Any group, worthy of some kind of recognition, but not as a full species, was treated as a variety by Linnaeus and the majority of the botanists who followed him. Variety is the oldest subspecific unit. Those botanists who employ only one category below the species-level thus have historical usage on their side, but variety is a popular term which has had and does have many shades of meaning. Next oldest subspecific unit is the subspecies. This being a technical term, has experienced a less varied usage than variety and has been employed historically

for the most important variations under the species. Modern experimental taxonomy demonstrates that those morphological variations within the species are most important, which are correlated with geographic, ecologic, or physiological isolation. Such variations are the subspecies. Occasionally the varieties of the older botanists are coincidentally equivalent to subspecies, but more often these varieties are mere trivial genetic variations. On the other hand, some of the species of the older botanists are only subspecies, since large series today demonstrate intergradation. Those who restrict the use of variety to the major units beneath the species, which possess geographic, ecologic, or physiological isolation, are assigning a new meaning to the term. If botanists prefer in this manner to break with tradition by redefining *varietas* and thus prevent the development of a uniform style of nomenclature for both plants and animals, they should at least realize what they are doing. If, on the other hand, they wish to establish a more uniform style for subspecific groups in zoology and botany and continue the usage of many outstanding botanists, they can employ the subspecies for the major divisions of species and continue using variety in its traditional sense, as the horticulturists do.

In the preparation of this paper, there has been much help from many colleagues, to all of whom I express hearty thanks.

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TRANSFERS IN *PYROLA*:—

PYROLA VIRENS Schweigg., var. **convoluta** (Barton), comb. nov. *P. convoluta* Barton, *Fl. Phil. Prodr.* 50 (1815). *P. chlorantha* Sw., var. *convoluta* (Barton) Fernald in *RHODORA*, xxii. 52 (1920).

P. VIRENS, var. **saximontana** (Fernald), comb. nov. *P. chlorantha*, var. *saximontana* Fernald, *ibid.* 51 (1920).

P. VIRENS, forma **paucifolia** (Fernald), comb. nov. *P. chlorantha*, var. *paucifolia* Fernald in *RHODORA*, l. c. (1920). *P. chlorantha*, forma *paucifolia* (Fernald) Camp in *Bull. Torr. Bot. Cl.* lxvii. 464 (1940). *P. paucifolia* Camp (by implication incorrectly attributed to Fernald), l. c. (1940).

Pyrola virens Schweigg. in Schweigg. & Koerte, *Fl. Erlang.* i. 154 (1804) antedates by six years *P. chlorantha* Sw. (1810). It has been taken up by Litardière in Briquet, *Fl. Corse*, iii¹. 168 (1938), by Becherer in *Ber. Schweiz. Bot. Ges.* l. 413 (1940) and by Mansfeld in *Fedde, Repert.* xlix. 47 (1940).

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